

TITLE OF THE INVENTION

APPARATUS FOR SWITCHING PAPER FEED DIRECTION OF IMAGE FORMING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority of Korean Patent Application No. 2002-37458, filed June 29, 2002 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to an image forming device, i.e., an office machine such as a laser printer or a copy machine, and more particularly, to an apparatus to switch a paper feed direction of an office machine capable of reducing a resistance against a paper while feeding the paper to prevent the paper from being blocked due to jamming or curling.

Description of the Related Art

[0003] Generally, an image forming apparatus for duplex (double-sided) printing, for example, a duplex printing laser printer 1 shown in FIG. 1 includes a paper feeding cassette 10 to stack papers, a pickup roller 20 disposed at an upper portion of the feeding cassette 10 to pick up a paper P, a paper feeding guide 22 forming a paper feeding path A to guide the paper P picked up by the pickup roller 20, and a developing unit 30 to form a toner image on a side of the paper P fed through the paper feeding guide 22. The laser printer 1 also includes a fixing unit 40, 41 to fix the toner image formed on the side of the paper P which has passed through the developing unit 30, a feeding roller 50 to feed the paper P which has passed through the fixing unit 40, 41, and a paper discharging roller 60 disposed at an upper side of the feeding roller 50 to discharge the paper P. The laser printer 1 further includes a paper duplex guide 62 forming a paper re-feed path B to re-feed the paper P discharged through the paper discharging roller 60 in order to print the other side of the paper P in a duplex printing mode, and first and

second duplex rollers 70, 90 to re-feed the paper P through the paper duplex guide 62.

[0004] The developing unit 30 includes a photoconductive drum 32 to form an electrostatic latent image by receiving a light signal such as a laser beam from an LSU (Laser Scanning Unit) 36 and a developing roller (not shown) to develop a toner image by attaching toner onto the electrostatic latent image formed on the photoconductive drum 32.

[0005] The photoconductive drum 32 of the developing unit 30 is provided at a lower portion with a transfer roller 34 to transfer the toner image formed on the photoconductive drum 32 onto the paper P.

[0006] The fixing unit 40, 41 has a fixing roller 40 and a heating roller 41 to fix the toner image transferred onto the paper P by applying heat and pressure.

[0007] A paper feed direction switching apparatus 42 is disposed in the vicinity of the paper discharging roller 60 to be elastically hinged between the paper feeding guide 22 and the paper duplex guide 62 to guide the paper P to the paper duplex guide 62 in the duplex printing mode.

[0008] As shown in FIGS. 2 and 3, the paper feed direction switching apparatus 42 includes a long shaft 44, a plurality of paper guide ribs 43 disposed at the shaft 44 at predetermined intervals across a paper feed direction to guide the paper P, an elastic spring 45 with one end 45a supported by a frame 47 (see FIG. 3) and another end 45b supported by a supporting hole 48a of a spring supporting part 48 formed at the shaft 44 to elastically restore the paper guide ribs 43 to an original position after the paper P passes through the paper guide ribs 43 while pushing the paper guide ribs 43, and a lever 46 disposed at one end 44a of the shaft 44 to remove a jammed paper P.

[0009] In order to sense that the paper P has passed, a sensor actuator 49 is disposed at another end 44b of the shaft 44 to move in association with the shaft 44 rotating when the paper guide ribs 43 fixed to the shaft 44 are pushed by the paper P. Also, a paper sensor 49a is disposed at a corresponding portion of the frame 47. The paper sensor 49a may be an optical sensor, and has a light emitting part and a light receiving part.

[0010] A duplex printing process of the laser printer 1 with the above construction will be described hereinafter. First, one of the papers P stacked at the paper feeding cassette 10 is picked up by the pickup roller 20 and then moved to the developing unit 30 through the paper feeding guide 22.

[0011] An electrostatic latent image is formed on the photoconductive drum 32 of the developing unit 30 by a laser beam emitted from the LSU 36. The laser beam corresponds to an image signal, and a toner is attached to the electrostatic latent image formed on the photoconductive drum 32 by the developing roller to be developed to a toner image which can be seen.

[0012] The toner image formed on the photoconductive drum 32 is transferred on to one side, for example, a top side of the paper P by the transfer roller 34 when the paper P is fed to the developing unit 30 through the paper feeding guide 22. The toner image transferred to the top side of the paper P is fixed thereon by the heating roller 41 and the fixing roller 40 included in the fixing unit.

[0013] The paper P which has passed through the heating roller 41 and the fixing roller 40 is fed to the paper discharging roller 60 by the feeding roller 50.

[0014] At this point, the paper P pushes the paper guide ribs 43 of the paper feed direction switching apparatus 42 from a position illustrated with a solid line to a position illustrated with a dotted line in FIGS. 1 and 3 by a rotational power of the feeding roller 50, while passing through the paper guide ribs 43. Thereafter, the sensor actuator 49 is separated from the paper sensor 49a and the paper sensor 49a senses that the paper P has passed.

[0015] In a simplex (single-sided) printing mode, the paper P is discharged to a paper tray 59 through the discharging roller 60.

[0016] However, in the duplex printing mode, the discharging roller 60 is driven to rotate backward by a separate forward/backward rotation driving controller (not shown) in correspondence with a signal generated at the paper sensor after a rear edge of the paper P is passed through the paper guide ribs 43. Thereafter, the paper P is fed to the paper duplex

guide 62 without being discharged to the outside. At this point, since the paper guide ribs 43 are restored elastically to the position illustrated with the solid line in FIGS. 1 and 3, the paper P may be easily fed to the paper duplex guide 62 by the paper guide ribs 43.

[0017] The paper, which has reached the paper duplex guide 62, is fed to an arranging roller 80 by the first duplex roller 70. The arranging roller 80 is disposed to be sloped at an angle of about 5 degrees so that a leading edge of the paper P is pushed and arranged by the arranging roller 80.

[0018] The paper P arranged by the arranging roller 80 is passed through the second duplex roller 90 back to the paper feeding guide 22, and another side, that is, a bottom side of the paper P is printed on as described before, whereby the paper P is discharged to the paper tray 59.

[0019] According to the conventional laser printer 1, since the paper guide ribs 43, which guide the paper P printed on the one side thereof to a paper duplex path B, block a paper feeding path A by the elastic spring 45, the paper P encounters great resistance from an elastic force of the elastic spring 45, a weight of the paper guide ribs 43, etc., when the paper P passes through the paper feeding path A.

[0020] When the paper P encounters resistance, the paper P cannot move smoothly but is blocked due to curling and jamming, thereby degrading reliability of the printing.

SUMMARY OF THE INVENTION

[0021] Accordingly, it is an aspect of the present invention to solve at least the above problems and/or disadvantages and to provide at least the advantages described hereinafter.

[0022] Another aspect of the present invention is to solve the foregoing problems by providing an apparatus to switch a paper feed direction of an office machine capable of reducing a resistance against a paper while feeding the paper to prevent the paper from being blocked due to jamming or curling.

[0023] Additional aspects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention

[0024] Additional aspects and/or other advantages are realized by providing an apparatus to switch a paper feed direction of an image forming device having a frame, the apparatus including a paper feeding path of the paper; a paper guide part disposed across the paper feeding path to be movable from an initial position to an operation position; a supporting part to rotatably fix the paper guide part to the frame of the office machine; an elastic restoring part to restore the paper guide part from the operation position to the initial position; and a restoring force blocking part to block a force of the elastic restoring part from acting on the paper guide part until the paper guide part fixed to the supporting part rotates beyond a predetermined angle.

[0025] The elastic restoring part may include an elastic spring with a first end fixed to the supporting part and a second end fixed to the frame, and the restoring force blocking part includes a movable fixing part to movably support the first end of the elastic spring to move within a predetermined range when the supporting part is rotated.

[0026] The movable fixing part may include a supporting groove having a circular arc shape disposed at the supporting part with respect to a center of the supporting part to move the first end of the elastic spring within the predetermined range to prevent the paper guide part from being pushed against the paper until the paper guide part is rotated beyond the predetermined angle.

[0027] The apparatus may further include a paper sensor, and a sensor actuator disposed at the supporting part to operate the paper sensor disposed at the frame, the paper sensor sensing whether the paper has passed through the paper guide part.

[0028] The apparatus to switch the paper feed direction may further include a lever to rotate the paper guide part fixed to the supporting part beyond the predetermined angle to remove a paper jam when the paper is blocked or jammed at the paper guide part.

[0029] The initial position of the paper guide part may be a position of the paper guide part where the paper guide part is disposed across the paper feeding path to enable the paper to be guided to a paper duplex path of the office machine for a duplex printing, and the operation range of the paper guide part includes a first range where the paper guide part is rotated at the predetermined angle to discharge the paper to an outside of the office machine through the paper feeding path and a second range where the paper guide part is rotated beyond the predetermined angle in order for the lever to remove a paper jam.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the preferred embodiment, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a cross sectional view of a conventional duplex image forming device;

FIG. 2 is a perspective view of a paper feed direction switching apparatus of the image forming device of FIG. 1;

FIG. 3 is a side view illustrating the operation of the paper feed direction switching apparatus of FIG. 2;

FIG. 4 is a perspective view of a paper feed direction switching apparatus in accordance with an embodiment of the present invention; and

FIGS. 5a, 5b and 5c are side views illustrating the operations of the paper feed direction switching apparatus of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0032] An apparatus to switch a paper feed direction according to the embodiment of the present invention will be hereinafter described in detail with reference to the accompanying

drawings.

[0033] A laser printer having a paper feed direction switching apparatus 100 according to the embodiment of the present invention includes features similar to those shown in FIG. 1, and thus, these elements are not illustrated again. These elements include a paper feeding cassette to stack papers, a pickup roller disposed at an upper portion of the feeding cassette to pick up a paper, a paper feeding guide forming a paper feeding path to guide the paper picked up by the pickup roller, and a developing unit to form a toner image on a side of the paper fed through the paper feeding guide. The present apparatus 100 also includes a fixing unit to fix the toner image formed on the side of the paper which has passed through the developing unit, a feeding roller to feed the paper which has passed through the fixing unit, a paper discharging roller disposed at an upper side of the feeding roller to discharge the paper, and a paper duplex guide to form a paper duplex path to re-feed the paper discharged through the paper discharging roller in order to print another side of the paper in a duplex printing mode, and first and second duplex rollers to re-feed the paper through the paper duplex guide 62.

[0034] The paper feed direction switching apparatus 100 is disposed between the paper feeding roller and the paper duplex guide to guide the paper to the paper duplex guide in the duplex printing mode.

[0035] As shown in FIGS. 4 and 5a, the paper feed direction switching apparatus 100 includes a paper guide part 143 disposed across the paper feeding path to move from an initial position (FIG. 5A) to a paper passing position (illustrated with a dotted line in FIG. 5B), or from the initial position to a paper jam removing position (illustrated with a dotted line in FIG. 5C) by a power generated by the passing of paper P or external power. The apparatus 100 also includes a supporting part 144 to rotatably fix the paper guide part 143 to a frame 147 of an image forming apparatus, an elastic restoring part 145 to restore the paper guide part 143 from the paper jam removing position to the paper passing position and a restoring force blocking part 148 to block a force of the elastic restoring part 145 from acting on the paper guide part 143 until the paper guide part 143 fixed to the supporting part 144 rotates beyond a predetermined angle, for example, the paper passing position.

[0036] The paper guide part 143 includes a plurality of guide ribs disposed across the paper feeding path at predetermined intervals of a long shaft forming the supporting part 144, to guide the paper P.

[0037] Each of the paper guide ribs has a first guide surface 143a to guide the paper P toward the paper tray and a second guide surface 143b to guide the paper to the paper duplex path in the duplex printing mode.

[0038] As shown in FIG. 5A, in the initial position disposed across the paper feeding path, the paper guide part 143 is positioned to be sloped with respect to a surface perpendicular to a paper feed direction in order for the first and second paper guide surfaces 143a, 143b to easily guide the paper.

[0039] The shaft of the supporting part 144 is rotatably supported by a bracket (not shown) of the frame 147 of the duplex laser printer.

[0040] The elastic restoring part 145 includes an elastic spring with one end 145a supported by the frame 147 and another end 145b supported by the restoring force blocking part 148 to elastically restore the paper guide part 143 to the paper passing position, when passing of the paper P is completed or external power is removed after the paper guide part 143 is pushed beyond the paper passing position.

[0041] The elastic spring of the elastic restoring part 145 applies an elastic force to the guide part 143 to be restored to the paper passing position, however the paper guide part 143 is restored from the paper passing position to the initial position by the weight thereof, a restoring inertial force and the restoring force blocking part 148, which will be described later.

[0042] The restoring force blocking part 148 has a movable fixing part 148a to movably support the other end 145b of the elastic restoring part 145 within a predetermined angle or a limit of a moving range L when the shaft of the supporting part 144 is rotated by the paper guide part 143.

[0043] The movable fixing part 148a includes a supporting groove formed as a circular arc with respect to the center of the shaft.

[0044] The paper feed direction switching apparatus 100 further includes a sensor actuator 149 fixed at one end 144b of the shaft of the supporting part 144 to operate a paper sensor

149a disposed at the frame 147 in order to sense whether the paper P has passed when it is moved through the paper feeding path while pushing the paper guide part 143.

[0045] The sensor actuator 149 blocks the paper sensor 149a such as an optical sensor including a light emitting part (not shown) and a light receiving part (not shown) to generate an 'off' signal, when the paper guide part 143 is in the initial position, as illustrated with the solid line in FIG. 5B. The sensor activator also moves in association with the shaft of the supporting part 144 and operates the paper sensor 149a to generate an 'on' signal when the paper guide part 143 is pushed by the paper P to the paper passing position, which is illustrated with the dotted line in FIG. 5B.

[0046] The paper feed direction switching apparatus 100 may further include a lever 146 to rotate the shaft of the supporting part 144 to remove a paper jam when the paper P is blocked or jammed by the paper guide part 143. The lever 146 is disposed at another end 144a of the shaft of the supporting part 144.

[0047] As shown in FIG. 5C, the lever 146 removes the paper jam by moving the paper guide part 143 to between the initial position illustrated with the solid line to the paper jam removing position when the paper is jammed at the paper feeding path or paper duplex path.

[0048] With the paper feed direction switching apparatus 100 as described above, even though the paper guide part 143 is rotated by the paper P to the paper passing position, which is illustrated with the dotted line in FIG. 5B when the paper P has passed through the paper feeding path, the elastic force of the elastic restoring part 145 does not act on the paper P due to the movable fixing part 148a of the restoring force blocking part 148. Thus, only the weight of the paper guide part 143 acts on the paper P, thereby reducing resistance against the paper P and consequently preventing the paper P from being blocked due to curling and jamming.

[0049] Furthermore, when the paper guide part 143 is rotated beyond the paper passing position by the lever 146, that is, to the paper jam removing position, which is illustrated by the dotted line in FIG. 3c, the elastic spring 145 applies an elastic restoring force to the paper guide part 143. Therefore, when the external force is removed from the lever 146 after the paper jam is removed, the paper guide part 143 is restored to the paper passing position by the elastic restoring part 145, and then to the initial position by the restoring inertial force and the weight thereof.

[0050] Hereinafter, the operation of the paper feed direction switching apparatus 100 will be described in detail.

[0051] First, a toner image is formed on one side of the paper P through the developing unit and is fixed thereon through the fixing unit, and then the paper P is fed to the paper feed direction switching apparatus 100 by the rotational power of the feeding roller, whereby the paper guide part 143 is pushed by the paper P to the paper passing position, which is illustrated with the dotted line in FIG. 5B.

[0052] Here, the elastic force of the elastic restoring part 145 does not act on the paper P by the circular arc forming a supporting groove (movable fixing part) 148a of the restoring force blocking part 148, and thus, only the weight of the paper guide part 143 acts on the paper P, thereby reducing the resistance against the paper P and consequently preventing the paper P from being blocked due to curling and jamming.

[0053] As the shaft of the supporting part 144 rotates, the sensor actuator 149 fixed at the one end 144b is separated from the paper sensor 149a, and thus the paper sensor 149a transmits an 'on' signal to a control unit.

[0054] As the paper sensor 149a transmits the 'on' signal, the control unit operates the paper discharging roller to discharge the paper P toward the paper tray.

[0055] Next, when the rear edge of the paper P is passed through the paper guide part 143, the paper guide part 143 pushed by the paper P is restored to the initial position by the weight thereof. As a result, the sensor actuator 149 fixed at the one end 144b of the shaft of the supporting part 144 is moved toward the paper sensor 149a, and consequently the paper sensor 149a transmits an 'off' signal to the control unit.

[0056] In the simplex printing mode, the control unit continues to operate the paper discharging roller to discharge the paper P to the paper tray.

[0057] On the other hand, in the duplex printing mode, the control unit operates the paper discharging roller to be rotated backward by the separate forward/backward rotation driving controller (not shown) in correspondence with the 'off' signal from the paper sensor 149a. Therefore, the paper P is not discharged to the paper tray, but enters into the paper duplex guide.

[0058] Here, as the paper guide part 143 is restored to the initial position by the weight thereof, the paper P is guided by the paper guide part 143 to easily enter into the paper duplex guide.

[0059] The paper P fed to the paper duplex guide is fed again to the paper feeding guide through the first duplex roller, the arranging roller and the second duplex roller, and then after an image is formed on the other side of the paper P through the printing operation, the paper P is discharged to the paper discharging tray.

[0060] As described above, the paper feed direction switching apparatus in accordance with the embodiment of the present invention includes the restoring force blocking part to block the elastic force of the elastic restoring part from acting on the paper guide ribs until the paper guide ribs are rotated beyond the predetermined angle, thereby reducing resistance against a paper and consequently preventing the paper from being blocked due to curling and jamming.

[0061] Although an embodiment of the present invention has been shown and described, it will be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.